Computer Assisted Medication and Patient Information Interface (CAMPII)

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1. Abstract

Purpose: The Computer Assisted Medication and Patient Information Interface project (CAMPII) developed a tool to collect medication and hypoglycemia information from diabetes patients, to enhance communication with providers and improve patient treatment outcomes. CAMPII:

- Designed a patient friendly computer assisted self-interview with input from clinical and human factors experts and patients. CAMPII addressed municipal hospital needs with simple touchscreen navigation, clear visual elements, voiceovers, and easy, non-judgmental questions, helping patients report medications, adherence and hypoglycemia.
- Developed a provider interface to reconcile patient-entered data and print medication instructions.
- Assessed interface accuracy, acceptability, perceived time efficiency, and utility from provider and patient perspectives.

Scope: Communication limitations for diabetes population with high prevalence of co-morbidity poly-pharmacy, and low health literacy.

Methods: Clinical content expert outlined basic design requirements. Human factors experts and experienced programmer drafted Interface elements and navigation. Final interface was in collaboration with multiple patients who used and critiqued the interface in interviews and questionnaires.

Both crossover and randomized trials compared CAMPII to traditional and customized paper instruments, the medical chart and a comprehensive "gold standard" interview by clinical pharmacist/Certified Diabetes Educator.

Results: CAMPII was more accurate than traditional paper methods and compared favorably with the medical chart and comprehensive interview for medication accuracy. CAMPII was more sensitive than all other methods, including the medical chart, for hypoglycemia with somewhat more false positives. Providers felt CAMPII saved time and improved information quality. Patients preferred CAMPII to paper forms. All were faster than the comprehensive interview.

Key Words: diabetes, medication, hypoglycemia, decision support, African-American, safety-net, computer-assisted self-interview (CASI).

2. Purpose

Studies show that control of glucose and other physiologic risk factors can reduce complications and cost of diabetes. Fear of hypoglycemia is the major barrier to increasing diabetes medications. Failure to elicit complete, accurate data in a timely manner precludes or delays the decision making necessary to attain good diabetes control. The goal of the Computer Assisted Medication and Patient Information Interface (CAMPII) project was to develop and test a tool to improve and standardize the flow of information between patients with diabetes and their providers. Therefore CAMPII focused on key time intensive information needed to make diabetes therapy changes: medications being taken and the most common limiting adverse event, hypoglycemia. The goal was to develop a simple to use, accurate computerized tool to assist patients to supply this information.

The CAMPII tool is an accessible, touch-screen computer interface patients can use in the clinic, to report medication information and adverse hypoglycemia. The patient information interface is designed to collect complete and accurate medication and to screen systematically and non-judgmentally for important details adherence and hypoglycemic events. CAMPII is

designed to be used prior to the patient's encounter with provider and with modest changes and proper security, could be used from home via an internet based patient portal.

Design requirements had to address health and computer literacy as well as vision challenges. It needed to provide memory prompts and medication recognition help. The interface had to enable providers to clarify and supplement the patient's computer assisted self-interview and to allow printing of clear, detailed instructions, and motivational information for patients and a daily medication schedule for patients.

Crucial to success would be involvement of human factors experts and frequent, detailed patient input during development. Testing was required to assure utility.

Proposed Specific Aims

Specific Aim 1 - Patient interface prototyping: The team will complete development of patient information interface which will obtain the essential information to make appropriate management decisions for – medication details, adherence, and adverse reactions including hypoglycemia.

This interface will obtain the essential information to make informed therapeutic decisions for diabetes and its major cardiovascular risk factors – medication names, doses and timing, adherence to the prescribed regimen and limiting hypoglycemia. This will be expected to reduce management errors due to inadequate medication information and lack of awareness of hypoglycemic and other adverse reactions. The interface will be web based for easy accessibility and deployment, include voice prompts and medication pictures to mitigate limitations in health literacy and include touch screen technology to emulate more familiar technologies (grocery store) and reduce needs for typing skills. Qualitative interviews during development were the most productive evaluation tool.

Specific Aim 2 - Provider interface prototyping: Team will develop the provider medication interface to enable provider correction of incoming medication data, entry of the new drug regimen and printing of prescriptions and medication instructions, with a daily medication schedule including pill pictures, medication purpose and expected benefits and potential adverse reactions. This schedule will be useful for improving adherence and communicating to medical providers outside the diabetes clinic. The educational details may motivate better adherence. Outcomes will be IBM Computer User Satisfaction Questionnaire scores and positive ratings in qualitative interviews during development.

Specific Aim 3 – Full interface evaluation: The team will assess the accuracy, acceptability, time efficiency and utility of the patient information interface for both providers and patients. Team will evaluate the completeness and accuracy of the medication information obtained by traditional and computer assisted methods against the reference standard of comprehensive multi-source interview by an experienced pharmacy expert. Patients and providers will use industry standard questionnaires and qualitative interviews to score satisfaction. Time will be assessed by program timers and direct observation. Utility will be assessed by measuring patient medication self-efficacy, adherence and medication errors in a small randomized controlled trial of CAMPII vs. controls.

3. Scope

Diabetes is common, costly and deadly, especially for African-Americans who have an increased rate of diabetes and its complications. Many studies show prevention of complications with control of glucose and other risk factors[1,2,3]. However, the failure to achieve good control of these risk factors in the majority of persons with diabetes indicates that barriers remain[4]. This is also true among the Grady Health System population which is 90% African-American with

health literacy, transportation, financial and other challenges[5].

While some of the barriers to control lie with provider inaction[6], data also suggest a breakdown in information flow between patient and provider. Patients supply incomplete or inaccurate information to the provider[7] resulting in inappropriate management decisions. Effective management of diabetes requires input and review of complete and accurate medication information and adverse events. Obtaining that information is time consuming and often derailed by discussion of other issues resulting in fragmented and incomplete drug information.

Providers often supply inadequate or misunderstood information to the patient which leads to inappropriate therapeutic behavior [8]. Much of the information needed concerns medication: actual behavior and adverse drug events from the patient and clear[9] detailed instructions and motivational information from the provider. **A tool to facilitate and standardize the flow of more comprehensive information in a resource-preserving manner is needed. The Computer Assisted Medication & Patient Information Interface (CAMPII) is designed to meet that need.**

Incorrect medication histories contribute to prescribing errors and adverse drug events (ADEs). Failure to report non-adherence has also been known to cause medication-related patient ADEs. Limited health literacy, aging, and poly-pharmacy deter patients from accurately describing their medication histories.

The setting was Grady Diabetes Clinic that delivers care for diabetes, hypertension and hyperlipidemia to an economically disadvantaged minority population with low health literacy. Grady Health System is a public municipal safety net hospital that serves Fulton and DeKalb, the first and third most populous Georgia counties that contain the city of Atlanta. The prevalence of diabetes in the 2009, registered Grady patient population was 12.3% based on billing diagnoses; however, 24% of the facility dollars billed went to this population.

The multi-disciplinary clinic is staffed by 6 endocrinologists, 6 senior nurse Certified Diabetes Educators, full-time podiatrist, dietitian, ophthalmic technician and a dedicated complement of receptionists, medical assistants and part-time clinical pharmacist/CDE. There are 3-4 new and 9 established patient half-day medical management, 9 half-day podiatry and 9 half-day clinics. In addition, retinal screening photography is performed and there are group self-management and individual dietitian classes.

During the study the Center's average patient age was 62 years; 58% female; 93% African-American. At least 70% of the patients are taking five or more prescriptions, and about 79% of the patients see more than one provider who may or may not be within the Grady Health System. In addition to the previously described challenges, these patients also frequently transitioned from one healthcare provider to another, which increases the chance of medication discrepancies. At each clinic visit, patients verbally report their medications and adherence to the nurse, who records this information in the paper-based medical chart. This process consumes a large fraction of the visit time. The clinic maintains its own computerized patient registry, the Diabetes Patient Tracking System (DPTS), but at the time of this study there was no health-system wide electronic medical record system.

Anticipated vs Actual Recruitment
Targeted enrollment was 105 diabetes patients reflective of the historical clinic population distribution: 59% female and 88% African-American; 100% of whom have diabetes. Study participants were recruited from diabetes patients in the Grady Diabetes Center waiting room, prior to clinic visit. Participation required a pending nurse-physician visit, visual acuity to read 14-point font, ability to read and understand English text, and willingness to remain after discharge to complete pharmacist interview.

Participants (n=242) consented to participate in one of three trials, Final participant population was 221 - 63% female and 95% African-American:

- Patient user interface development of the CAMPII model (n= 29);

- Crossover comparison of CAMPII to medical chart and paper surveys to collect accurate and complete medication history, adherence, and adverse events: each patient used all three information instruments (n= 117; AIM-1);

- Randomized trial of CAMPII kiosk vs paper survey and usual care for collection of medication history, adherence, and adverse events: each patient was randomized to one of the three survey groups (kiosk; paper; usual care) (n=75; AIM-3).

A)	Targeted Enrollment (n=105) Sex/Gender			Completed Enrollment (n=242) Sex/Gender			Completed Protocols (n=221) Sex/Gender		
Ethnic Category	Female	Male	Total	Female	Male	Total	Female	Male	Total
Hispanic or Latino	8	5	13	2	1	3	1	1	2
Not Hispanic or Latino	54	38	92	150	89	239	138	81	219
Ethnic Category: Total	62 (59%)	43	105	152 (62%)	90	242	139 (63%)	82	221
Racial Categories	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**
American Indian /Alaska Native	0	0	0	1	0	1	1	0	1
Asian	0	0	0	1	2	3	1	1	2
Native Hawaiian /Other Pacific Islander	0	0	0	0	0	0	0	0	0
Black or African American	54	38	92 (88%)	144	86	230 (95%)	134	77	211 (95%)
White	8	5	13	2	3	5	2	3	5
Other				3	0	3	2	0	2
Total	**62**	**43**	**105**	**151**	**91**	**242**	**140**	**81**	**221**

Enrollment of women and minority participants:
Women: 59% planned; 62% of enrolled; 63% of final.
African Americans: 88% planned; 95% of enrolled; 95% of final.

Some participants (n=21) were withdrawn or excluded after consent or had their participation aborted for clinic flow reasons. Reasons included:

No established nurse/physician visit (walk-in, new patient, physician visit type misreported), required transfer to urgent care or left clinic without discharge encounter (29%); off medications > 6 months (9%), clinic flow driven interference (29%), reading/writing problems (19%), patient self-withdrawal / severe pain / duplicate enrollment in year 3 (14%).

Participants withdrawn did not differ descriptively from participants retained in the study:

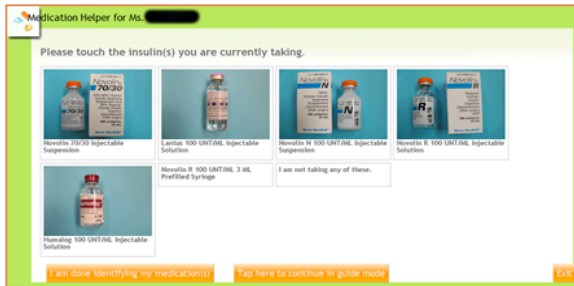| Total Consented=242	Withdawn (n=21)	Retained (n=221)
Average Age	54	54
Female	57%	63%
African-American	95%	95%
Average A1c	10.2	8.1
BMI	29.7	33.1
BP Systolic	127	125
RBG @ visit	268 (118-405)	170 (29-575)
Education 4 Categories:	16.7% reported < 9th grade education; 19% had reading problem-withdrawal	4.5% reported < 9th grade education

4. **Methods**

Aim-1 Methods (CAMPII Patient Interface Development and Crossover Testing): A total of 146 participants were recruited. Phase-1 design and development subjects (n=29) and Phase-2 pilot subjects (n=117) were enrolled to inform design and test the patient interface.

CAMPII Design Methods. My Medication Helper (MMH), a computer kiosk for low-literacy diabetes patients to report current medications and hypoglycemic events, was designed using a work-centered methodology. The design of the MMH interface was driven by UFuRT 1 (User, Function, Representation, and Task analyses) a systematic methodology based on work-centered research and the theory of distributed cognition (Figure 1).

Primary user analysis revealed limited computer experience, low-literacy, some decreased vision, poly-pharmacy, and aging. The functional analysis identified the required work domain. The representation analysis found that visual, audio and textual clues were essential to help users recall and recognize the drugs. The task analysis further defined the steps for performing the functions. Technically, MMH was designed to ensure interoperability, portability, and availability. This web-based application was programmed in ColdFusion, Ajax, and JQuery. RxNorm (National Library of Medicine) supplied the data vocabulary.

MMH was prototyped in four iterations. After two domain experts confirmed that MMH supported the work functions, a usability expert performed a cognitive walkthrough to identify usability issues. Subsequent iterations used 29 consenting municipal hospital diabetes clinic patients for a prototyping study (19 before efficacy testing and 10 for later revision). The investigators and the usability expert observed the sessions and identified additional issues for mitigation. In the study, the subjects were asked to report their current medications on two different paper-based medication forms.

CAMPII User Analysis	
Diabetes patients, many had challenges such as literacy, decreased vision, polypharmacy, neuropathy and aging.	
Functional Analysis	
Goal #1 = Reports current medications	
Operation #1 = Select a medication	
Representation Analysis	**Task Analysis**
Medication is a categorical variable and can be represented as name or image in user's working memory. Hence, each medication is represented with correlated dimensions: image and drug name inside a box on the interface	Step #1: Visual search for a medication that matches the medication representation in the user's working memory. Step #2: Tap the image. Step #3: Tap continue button.
Image and Drug Name	

CAMPII Design Update (Aim-3). Design refinements resulting from review of Aim-1 pilot data were incorporated prior to implementation in the Aim-3 RCT. To improve scalability and

sustainability, in-house pill photos of formulary medications were replaced in the CAMPII model with pill images provided under a limited license agreement with First DataBank. Error-checking layers and reports were added, medication display and review features were modified.

AIM-1 Methods: Crossover Study.
In the AIM-1 crossover study, each subject completed medication, adherence, and hypoglycemia surveys for all three instruments: Kiosk, Paper-APha Survey, Paper-Custom Survey. Each subject completed (a) a CAMPII (KIOSK) medication, adherence, and hypoglycemia interview session with the touch-screen interface; (b) a one-page medication form developed by the American Public Health Association; and (c) a six-page checklist style form, customized to list the Grady Diabetes Clinic's usual medications and also contained hypoglycemia questions. In addition, the 117 pilot subjects completed a structured interview with a pharmacist who assessed the "truth" for both medication reconciliation (whether the patient had actually been taking the medication) and presence of hypoglycemia. The pharmacist used patient interview, home monitoring log or meter, patient survey reports (kiosk and paper), audit of available chart, EMR, and pharmacy data. CAMPII session data were collected, including process details for the CAMPII-patient interaction (e.g. duration of session, number of steps, seconds per screen, etc.); along with medication, hypoglycemia, and other information entered by patients on the computer kiosk. Data were coded and entered into a database to allow comparison of the patient information sources to the "truth." Multiple scoring methods were tested and reviewed. Aim-1 pilot data informed methods developed for the full interface evaluation and identified additional data elements needed for the Aim-3 trial.

Aim-2 Methods: Provider Interface Development.
Design of the provider medication interface was completed in spring 2011. The CAMPII provider interface was developed to support medication management functions, including medication reconciliation (correcting incoming medication data, entering new drug regimens) printing medication instructions, and producing a daily medication schedule for the patient.

Nurse-, endocrinologist- and pharmacist-provider interviews, testing and feedback informed the development of the CAMPII provider interface. Tasks and usability requirements included provider correction of incoming medication data, entry of new drug regimens, and printing of prescriptions and medication instructions. At the end of the visit, the study pharmacist used CAMPII to update current medications and generate a daily medication schedule for the patient to take home that included medication name, dose, frequency, purpose, expected benefits, and potential adverse reactions.

The priority focus for the project was the patient interface. The provider interface, while functional, is not as robust as the patient interface. Additional layers of error checking for entry are needed. These limitations were compensated for by use of trained study personnel (pharmacist) performing provider interface tasks during the Aim-3 randomized control trial for patients. Clinic flow required modification of the original model – replacing the discharge physician's interaction with the CAMPII provider interface with a post-visit pharmacist interview to reconcile medication and hypoglycemia issues and generate patient medication schedule, while performing medication and hypoglycemia audits.

Aim-3 Methods: Randomized Controlled Trial- Kiosk vs Paper vs Usual Care.
The patient interface was completed in September 2010, and enhanced in June 2011, prior to the randomized trial. The patient interface is designed for a full size touch-screen PC with a 20-inch monitor. Patients press (touch) large onscreen buttons and thus there are minimal dexterity or hand-eye coordination requirements for users. Voice-over instructions and reading of options minimize literacy requirements.

In Aim-3, 85 subjects were enrolled; 10 helped to address more development issues; 75 completed the randomized trial (25 per group). Medication lists were printed for patients enrolled in the computerized portion of the study, while patients enrolled in the paper-only portion were given paper so that they could write the information down. Patients enrolled in the usual care portion were not involved in either process. After 2-to-6 weeks, team members asked patients in the computerized and paper-only portions to locate their medications lists, if possible. With or without benefit of list, patients were asked to confirm current medicines.

Post Data Collection: Data collection was completed in fall 2011, at which time the study team began work on data analysis, synthesis, and reporting. A no-cost extension was requested and approved which extended the grant closing date from 9/29/11 to 9/29/12. During this period of minimal funding, ongoing tasks included data quality review and data management activities, review of outcomes, identification of key questions, development of pilot projects to clarify hypoglycemia screening and cross-discipline reliability of adverse events, planning for final publications and reporting and planning (grant applications) to move the project forward.   Final reviews will focus on assessment of the accuracy, acceptability, time efficiency, and utility of the patient information interface for both providers and patients.

5. Results

Analysis of final datasets is ongoing. Significant findings will be reported in peer-reviewed literature and conference proceedings, and will serve as foundation for additional investigation, development and translation.

Design findings: The multi-disciplinary team contributed diverse and complementary perspectives to a successful design. Human factors expertise is crucial for usable designs. It is difficult to imagine any more important design factor than having detailed testing and feedback from the patient user population. A systematic, work-centered methodology facilitates patient kiosk design and resulted in high levels of acceptance.

Prototyping study with subjects from the target population improved user acceptance and usability. A number of unexpected design considerations surfaced. Not all persons are used to the "QWERTY" keyboard, a few preferred an alphabetic keyboard layout. The preferred size and separation of buttons for this population was more than anticipated. Navigation and error capture routines had to be carefully done to avoid user frustration. The pill pictures were hardly used by participants. It was difficult to provide a simple navigation scheme for the pictures

CAMPII Design Phase Results. Mean subject age of the 29 development subjects was 55 (SD=9.4). 95% were African American and 37% had attended college; 53% of the subjects reported rarely or never having used a computer before; 79% reported MMH Kiosk was easier to use than the paper forms, and 89% felt MMH was more helpful in recalling their medications. Using a computer kiosk to acquire medication history is preferred by chronic disease patients with low-literacy, even though it took longer even if the patients rarely or never used computers.

Medication Accuracy of CAMPII Kiosk in crossover study was better than paper forms and compared favorably with the medical chart. Diabetic subjects (n=39) completed three medication reports: kiosk (KIOSK), American Pharmacists Association's standard form (APhA), and a clinic-specific customized checklist (CUSTOM). These were compared to the paper medical chart and a "gold-standard" medication history. The preliminary analysis is limited to "CORE" clinic priority medications for diabetes, hypertension, and lipids. Additionally, responses to hypoglycemia questions from KIOSK and CUSTOM were compared to those in the chart, which contained pre-printed screening questions.

Factor	No.	%/SD
Age (yr), mean/SD	54.9	10.9
Diabetes Duration (yr)	11.9	8.0
BMI	34.2	8.7
Sex (female)	25	64%
Race		
Black	37	95%
White	1	3%
Asian	1	3%
Education		
< High School	17	44%
High School	8	20%
Some college	12	31%
College or greater	2	5%
Brought medication list	20	51%
Pharmacies, 2 or more	7	18%
Own cell phone	31	80%

Factor	No.	%
Any computer access	24	62%
Ever used computer	26	67%
Computer difficult to use	18	46%
Computer use		
Rarely	16	41%
1 time / month	3	8%
1-2 time / week	5	13%
Almost daily	4	10%
Kiosks/ATM difficult	6	15%
User time, median (min)		
KIOSK	23	
APHA paper	7	
CUSTOM	8	
Easier method		
KIOSK	31	80%
Paper	3	9%

Most subjects (95%) were African American. Subjects were diverse in: education (44% less than high school, 36% some college); age (mean 55; range 32 to 84); and computer use (24% frequent users, 68% rarely or never used).Yet, 92% were familiar with touch-screen kiosk, and only 15% thought they were difficult to use. History was obtained for 228 drugs. Median user time was 23 min for KIOSK, 8 min for CUSTOM, and 7 min for APhA. Most subjects (80%) felt KIOSK was easier to use.

ACCURACY OF CORE MEDICATION REPORTING BY METHOD
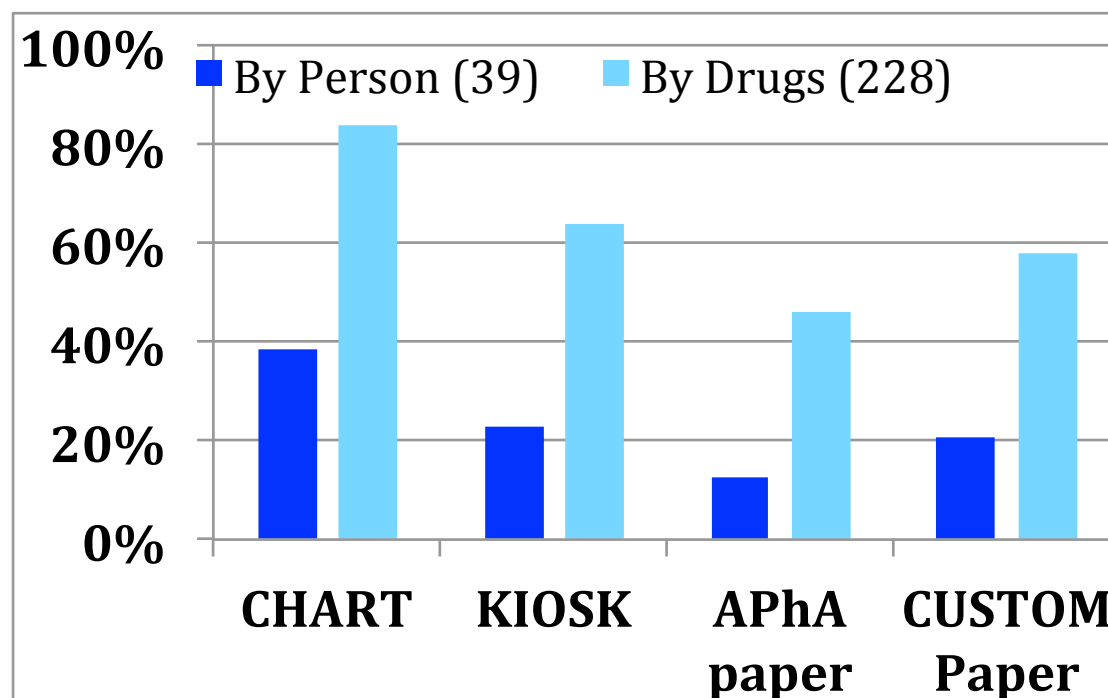
Relative to the gold-standard pharmacist interview, KIOSK was correct 64% of the time, besting both CUSTOM (58%, p=0.01) and APhA (46%, p<0.001). The chart was correct for 84% of CORE medications. KIOSK missed 12% of drugs, which was not different from CUSTOM (8%, p=0.17) or APhA (18%, p=0.07) forms, but worse than the chart (7%, p=0.04).

Comparing the entire list of core medications by person showed only 38% of charts were accurate while the KIOSK (23%) and CUSTOM (20%) were not statistically different. The APhA form was statistically worse at 13% list accuracy. Accuracy of reporting worsens (to ~ 10%) when all medications, including over the counter drugs, are scored and CUSTOM worsens more than the others (data not shown).

In the chart, hypoglycemia questions were unanswered for 26% of subjects. All CHART hypoglycemia reports (26%) were picked up by KIOSK and CUSTOM. KIOSK and CUSTOM reported an additional 20% of hypoglycemic subjects. The chart seemed insensitive for detecting the occurrence of hypoglycemia, an important adverse event. However, there was no gold standard interview for hypoglycemia among these 39 subjects, as the hypoglycemia discrepancy was an unexpected finding.

Compared to both paper forms, KIOSK, despite taking longer, was preferred by patients and was more accurate for collecting medication histories. KIOSK was more sensitive for detecting hypoglycemia compared to the chart and paper forms. A computer-assisted patient interview kiosk is a promising tool to improve accuracy of crucial medical decision making data. Used as a pre-visit tool, it should improve accuracy and efficiency of provider histories.

Only about half of patients bring their medication bottles or an accurate medication list to clinic visits. If deployed for home access, this may partly address the problem of "I was in a hurry and forgot my medication list".

Preliminary Impact and Findings: Hypoglycemia. An additional 47 participants completed KIOSK, paper and pharmacy interviews for hypoglycemia at a clinic visit.

Definition	Sensitivity	False Positive	Kappa	P (vs STND)
KIOSK, strict	91%	22%	0.661	<0.001
KIOSK, any	96%	54%	0.410	0.002
CHART	56%	0%	0.570	<0.001
PAPER, strict	96%	46%	0.494	<0.001
PAPER, any	96%	71%	0.245	0.048

Standardized review for hypoglycemia shows 38% of CHARTs failed to address hypoglycemia and had an overall 56% sensitivity for detection of hypoglycemia vs 91% to 96% for PAPER and CAMPII KIOSK. KIOSK had ~ half the false positives of PAPER form. KIOSK Kappa (agreement) was better than other methods. **CAMPII KIOSK is better for detecting hypoglycemia than chart documentation, although it has more false positives, and it is more specific than paper forms. It was also a more efficient tool from the provider perspective when compared to usual care.**

An extension of the hypoglycemia testing, used data from a detailed interview by PharmD/Certified Diabetes Educator, patient surveys, medical chart. Four Diabetes "EXPERTS" (2 endocrinologists and 2 PharmD's with diabetes clinic experience) adjudicated the likelihood of HYPO for 141 patients with diabetes as "definite", "probable", "possible", "doubtful" or "none". If ≥ 3 EXPERTS rated the probability as *probable* or *definite*, HYPO was rated as "*yes.*" If ≥ 3 EXPERTS rated the probability as *doubtful* or *no*, HYPO was rated as *no.* HYPO was rated as "maybe" if ≥ 3 EXPERTS rated HYPO as *possible* or if there was disagreement between ≥ 3 EXPERTS. Two HYPO screening tools, computer aided self-interview (CASI) and paper surveys (PAPER) were compared to CHART and to EXPERT ratings.

Population (N=141) was 96% African American and 61% female with mean age 53 $\pm$ 11 yr, diabetes duration 8.9 +/- 8.6(median = 6.0) yr and A1C 8.3$\pm$ 2.4%. Since their last visit, severe HYPO was uncommon (7%), but HYPO was common 33% definite and 22% possible. It was most frequently nocturnal and felt to be precipitated by reduced food intake. History of HYPO, being on insulin or secretagogues and lower A1C were risk factors for HYPO (all P<0.05). CAMPII (85%) was more sensitive than PAPER (63%) or CHART (55%) for detecting HYPO, but with more false positives (30%, 27%, 11%, respectively). CHART HYPO question was not answered 25% of time. Subjects liked the CAMPII KIOSK and providers liked having the pre-visit screening report.

Collaboration: The CAMPII project provided opportunities for collaboration with several institutions and received support from students of pharmacy, nursing, nutrition, and health anthropology from neighboring universities, and as well as community volunteers and professional colleagues. This support allowed examination of further explore relevant questions identified by preliminary data and an increase the number of subjects, Including Grady Health System, Mercer University College of Pharmacy and Health Sciences, Paul Kolm, PhD, Thomas Jefferson University, Health Anthropology, at Georgia State University, and University of Georgia.

Future Steps: Based in part on the development and testing of the CAMPII prototype (2009-2011), Dr. Ziemer applied for and was awarded (June 18, 2012) the American Diabetes Association/Nov Nordisk Award in Hypoglycemia in Diabetes (Grant # 7-12-HYPO-11). The project "Hypoglycemia Investigation, Intervention and Prevention Operation (HII-PO)" was based in part on questions raised, evidence collected, and IT tools created during the AHRQ CAMPII study.

Summary: The Computer Assisted Medication and Patient Information Interface project (CAMPII) developed and tested "My Medication Helper" (MMH) an innovative computer assisted self-interview. The CAMPII MMH is patient friendly system that is more accurate than traditional or customized paper forms. It proved better for detecting hypoglycemia than any other method, including the documented medical history. It was preferred by patients to paper forms and appreciated by providers. This tool can be deployed to improve care for patients with diabetes and improve provider accuracy and efficiency.

6. List of Publications and Products

1	Conference Abstracts, Posters, Presentations, Theses
1.1	Tsui CW. Development and Early Assessment of a Patient-Centered Kiosk for Medication Reconciliation: My Medication Helper (MMH) [masters thesis]. Houston, TX: University of Texas School of Health Information Sciences, 2010.
1.2	Ziemer DC. Computer Assisted Medication & Patient Information Interface (CAMPII): The Movie Version. Emory Endocrinology Research Conference, Emory University School of Medicine; 2011 Jan 31; Atlanta, GA
1.3	Ryan GJ, Caudle JM, Tsui CW, Hickman, JM, Barnes CS, Ziemer, DC. Improving Hypoglycemia History Using Computer Aided Interview. American Diabetes Association 71st Scientific Sessions; 2011 Jun 24-28; San Diego, CA.
1.4	Tsui CW, Caudle JM, Ryan GJ, Barnes CS, Hickman JM, Franklin A, Ziemer DC. Design and Development of a Computer-assisted Self-interviewing Kiosk for Low-literacy Patients to Ensure Medication Safety. American Medical Informatics Association Annual Symposium; 2011 Oct 22-26; Washington, D.C.

1.5	Ziemer DC, Ryan GJ, Caudle JM, Barnes CS, Hickman JM, Tsui CW. Computer-Assisted Medication and Patient Information Interface (CAMPII) is Accurate and Acceptable for Medication and Hypoglycemia Detection. American Medical Informatics Association Annual Symposium; 2011 Oct 22-26; Washington, D.C.
1.6	Ryan GJ, Caudle JM, Rhee MK, Hickman JM, Tsui CW, Barnes CS, Haomia J, and Ziemer DC. Medication Reconciliation: Comparing a Customized Medication History Form to a Standard Medication Form. American College of Clinical Pharmacy Annual Meeting; 2011 Oct 16-19; Pittsburgh, PA.
1.7	Ziemer DC. Computer Assisted Medication & Patient Information Interface (CAMPII). Emory Endocrinology Research Conference, Emory University School of Medicine; 2012 Jan 30; Atlanta, GA.
1.8	Ziemer DC. Computer Assisted Medication & Patient Information Interface (CAMPII). Promoting Effective Communication and Coordination of Care: Translatable Findings From Midsized AHRQ Health IT Grants. Agency for Healthcare Research and Quality Annual Conference; 2012 Sep 9-11; Washington, DC.
1.9	Ryan GJ, Newton CA, Caudle JM, Tsui CW, Quairoli K, Barnes CS, Ziemer DC. Better Hypoglycemia Detection Rating Scale. AACE 22nd Annual Scientific and Clinical Congress;2013 May 1-5; Phoenix, AZ.
2	**Journal Articles** *(includes work-in-progress)*
2.1	Ryan GJ, Caudle JM, Rhee MK, Hickman JM, Tsui CW, Barnes CS, Haomia J, and Ziemer DC. Medication Reconciliation: Comparing a customized medication history form to a standard medication form in a specialty clinic. (CAMPII 2). *Journal of Patient Safety. (*JPS-11-129R1; *accepted for publication June 2012)*
2.2	Tsui CW. Development and Early Assessment of a Patient-Centered Kiosk for Medication Reconciliation: My Medication Helper (MMH)*. International Journal of Medical Informatics.* (pre-submission).
3	**Products**
3.1	My Medication Helper (Initial prototype/demonstration video, 2010). Link/URL available from PI
3.2	Ryan GJ, Ziemer DC. Perceived Knowledge of Medications Survey (custom survey) 2010. Link/URL available from PI
3.3	Ziemer DC, Ryan GJ. Training video for graduate pharmacy students/CAMPII staff. (Provider-patient communication: Test video for identifying/timing medication/hypoglycemia elements within encounter), 2011. Link/URL available from PI
4	*Newspaper, Magazine articles*
4.1	Blum, K. Kiosk may be key to improved medication history capture. *Pharmacy Practice News*, Digital Edition 2012 March:56,58.
5	**Related Research Applications**
5.1	Ziemer DC (PI). Computer-expedited Medication Adherence Promoter (CMAP). NIH. Application Submitted February 15, 2012 in response to PA-12-023.
5.2	Ziemer DC (PI). Hypoglycemia Investigation, Intervention and Prevention Operation (HII-PO). American Diabetes Association - Novo Nordisk Award in Hypoglycemia in Diabetes. Awarded June 18, 2012. Grant Reference #7-12-HYPO-11. (The HII-PO project was based in part on questions raised, evidence collected, IT tools created during this AHRQ-sponsored "CAMPII" project.)
5.3	Mbaezue N. Medication adherence intramural grant application, Morehouse School of Medicine. Submitted April 2, 2012. Awarded 2012. (DC Ziemer, mentor)
6	**AHRQ Grant Reports (R21 HS 018236)**

6.1   Ziemer DC (Emory University School of Medicine, Atlanta, GA). AHRQ 2010 Grant Summary Report. Agency for Healthcare Research and Quality, Rockville, MD; 2010 Dec. R21 HS 018236.

6.2   Ziemer DC (Emory University School of Medicine, Atlanta, GA). AHRQ 2011 Grant Summary Report. Agency for Healthcare Research and Quality, Rockville, MD; 2011 Dec. R21 HS 018236.

6.3   Ziemer DC (Emory University School of Medicine, Atlanta, GA). Computer-Assisted Medication and Patient Information Interface (CAMPII): 2012. Final Report to AHRQ. Agency for Healthcare Research and Quality. Rockville, MD; 2012 Dec. R21 HS 018236.

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